

‘SportSURF, a new sports surface research community’

This article presents the content and outcomes of the launch seminar of the SportSURF network, held at the Holywell Science Park, Loughborough University on the 17/11/2005.

More than sixty delegates were brought together for the first inaugural meeting of SportSURF held at Loughborough University. SportSURF are a newly formed research network group set up to discuss many aspects of sports surfaces, including their design, materials, sustainability, play performance and their effects on the users.

Leading figures from the sports surface industry were present in the audience, they included Eric Harrison (FIFA consultant) STRI Chief Executive Dr. Gordon McKillop, Simon Winman of the RFU and figureheads from many other leading product manufacturers, research institutes and service providers.

This new group of stakeholders comprising of academics, practitioners, and sports governing bodies assembled for a full days seminar titled ‘Sports Surfaces- Current and Future Needs’.

The concept for SportSURF arose some time ago, and funding was successfully won from the Engineering and Physical Sciences Research Council by an application from a consortium of researchers and supported by many parties. It aims to create a network of stakeholders brought together to produce an integrated approach to sports surface research and development to benefit the stakeholders.

Background

SportSURF was set up in May 2005. The organisation comprises of a number of core committee members from several University establishments who are responsible for carrying out research and development, and SAPCA.

The specific aims and objectives of this new organisation are:

To advance the science and understanding of player-surface interactions and innovate the better engineering of surfaces to benefit play and end users health.

To create a new interdisciplinary sports surfaces community.
To host stimulating meetings / workshops open to all interested parties / stakeholders including a new conference dedicated to this subject area.
To transfer ideas, techniques, models and technology between researchers and practitioners. To produce multidisciplinary research proposals.
To disseminate network outcomes widely.

Membership of the network is open to any individual or organisation interested in the provision, management, maintenance and effects on the users of the full range sports surfaces, including sports governing bodies. Initially membership is free and members will be kept informed through its dedicated web site and twice yearly newsletter.

The network's objectives will be achieved by a variety of activities. These will include regular focussed workshops, research seminars, project and case studies.

Launch Seminar

The aim of the launch seminar was to bring together the member parties and stimulate discussion and debate regarding both the role of the network and the challenges that need addressing to advance the science of sport-surface interactions.

The seminar certainly packed in a full day of information and debate. The first part of the day comprised several informative presentations, and after lunch the workshop session comprised four 'breakout' groups debated some key questions and these were then fed back to the whole group.

The topics of the day addressed many issues that affect sport surfaces, including the surfaces, user perceptions, biomechanics and surface mechanics approaches to player –surface interaction, surface evaluation and modelling for player and ball, and the construction and sustainability of the sport surfaces.

Dr Paul Fleming, the network manager introduced the network to the delegates, and then chaired the presentations.
(The presentations can be viewed in full via the website.)

A. PRESENTATIONS

1. Surface requirements

Dr Paul Fleming opened up the proceedings with an introduction about SportSURF's aims and objectives.

Dr Fleming spoke about the rapid development of sports surfaces in recent years, and showed examples of artificial and natural turf, sports hall floors and tracks and so on. He touched on how they had affected the nation's perception and use of sports facilities.

Also highlighted was the fact that the current sports industry and research communities had not invested enough money in recent years to produce coherent collaborative research programmes. Thus there are many gaps in knowledge relating to three main areas: Scientific studies required to determine the most appropriate surface design for the benefit of the specific sport. The appropriate protection of users through long-term repeated use (especially for youngsters participating). Thirdly the technical innovations required to evaluate surfaces properly and to ensure the surfaces meet sustainability targets (through both design and construction materials and also during operation, e.g. water-based hockey pitches).

His presentation raised some interesting questions about the sports surface industry, particularly with regard to the testing and interpretation of both the surface materials and the overall facility. He also questioned the robustness of some present methods to accurately measure and determine performance criteria.

The case for further research and investigation into the measurement and testing of playing surfaces was well argued and it is clear the industry must address whether they are doing enough and what should be tested and how best to do so?

The questions raised from the floor included queries about the value of the Berlin Artificial Athlete and its continued long term use as the gold standard test. It was argued by one delegate that it is the best around.

Another issue raised was to why or whether we should expect artificial turf pitches to be more consistent than natural turf, as it is well documented that natural turf is variable and (elite) players prefer natural turf. Dr Fleming responded that perhaps the industry should strive for better consistency in

artificial surfaces as the materials are more controllable and somewhat less susceptible to the elements.

2. User Requirements

Colin Young, a researcher from the Department of Civil and Building Engineering at Loughborough University, gave an informative presentation of the user requirements on water based field hockey pitches.

He began his talk stating that most current pitches were designed and constructed without any prior consultation with the end users. Design was based on the back of a series of standards outlined by the sports governing bodies.

He described how he had carried out a comprehensive series of interviews and questionnaires to produce user survey to find out what the hockey players wanted or expected from a playing surface. He noted that the outcomes might be influenced by the users' standard of play, i.e. elite, amateur or beginner and in his study considered elite level only.

He showed that players had a number of key playing requirements for optimal performance, including underfoot grip, ball bounce and surface hardness. The study included comparing user feedback from 6 pitches to mechanical test results (e.g. ball bounce, ball roll, Berlin 'Force Reduction', traction etc).

He raised issues regarding that surfaces designed for multi-sports usage would of course have to comprise certain aspects from each sport. It is currently also unclear how users change their approach to a sport based on the surface they use.

He stated that there needs to be more research into the behaviour and expectations of the end user to have a clearer understanding of what the surface should offer in terms of sports performance and player safety.

A question was raised regarding the benefits of trying to establish objective user feedback when they were thought, by many apparently, to be too disparate. However, further general discussion highlighted the value of the user differentiation between performance of surfaces and in particular the disparity between some sport standard tests such as ball roll which clearly showed no link to the user feedback. The relatively strong link between user

feedback and measurements of ball bounce, surface hardness and traction were agreed as very encouraging for the continuation of certain tests.

3. Player Surface Interaction

Dr Sharon Dixon and Dr Iain James then jointly presented a talk aimed at showing how the integration of medical, biomechanical and engineering aspects of the sports surface and the player-surface interaction could be approached and combined in a research project.

They argued that surface 'engineering' must also consider the player-surface interaction if the provision and performance of sports surfaces is to be improved. To achieve this, they showed examples of measurements of player-surface interaction with a force plate and series of athletes and surfaces. Sharon showed data that suggested that the peak impact force from the athlete is not significantly affected by the surface type/hardness. However, she also showed that the more recently available technology for measuring in-shoe pressures was an improvement on relying upon force plates whereby the forces measured are relative to the athlete centre of mass and not the point of contact (i.e. the foot). The in-shoe measurements showed some increased heel impact forces on the stiffer surfaces.

Iain presented the findings in brief from several projects investigating the performance of natural turf, including from cricket and horse racing. These projects were aimed at investigating better spatial uniformity or prediction of performance to help reduce the potential for injuries or unpredictable play (affecting skills development).

There are a number of sports however, where natural turf remains the preferred choice and in many locations around the world, natural turf is the only affordable provision for sports participation. Therefore it is important that research continues to look at advancements in both natural and artificial surfaces for sport.

The questions and discussion focussed on the potential for integrating the approach with injury studies, and there was some comment that FIFA had done a lot of the work on injury in relation to the surface and shoes, though it was also suggested that this information may not have been widely published and thus was not in the public domain. It was agreed that any published information should be easily accessible and would aid current research.

4. Surface Assessment and Modelling behaviour

Dr Matt Carré spoke on the need to measure and evaluate mechanical behaviour that occurs during the interaction of the player and ball with the sports surfaces, with a focus on ball impact behaviour. A combination of lab and field-testing are essential to establish certain model information, for example recent studies have looked at studded boot traction, looking how different stud sizes and patterns can change the performance of the boot and its interaction with the surface.

He also informed the delegates about a series of ball measuring tests that can monitor the performance of tennis and cricket balls used on different surfaces. These tests measured the hardness of surfaces using the Clegg Hammer and ball drop devices, and used the information to help model the behaviour during impact to help with prediction of behaviour.

He presented information regarding the impact behaviour of rigid and non-rigid balls on surfaces that are rigid or non-rigid, and looked at the combined influence of both surface hardness and friction in determining the ball response to the impact. He gave examples of where the modelling had helped regulatory bodies in producing both guidance and new test regimes to evaluate the equipment used at top level sports, e.g. looking at ball-racket impacts for the ITF and predicting the behaviour of the whole ball flight during a service.

An interesting discussion followed regarding boot studs and whether any studies of the effect of bladed studs had been carried out. It was noted that several manufacturers had banned the use of bladed studs on their products due to both player injuries and damage to the surface.

5. Surface Measurement Methods

Colin Walker spoke passionately about the need to evaluate how modern surfaces, particularly the new '3rd Generation' long-pile artificial surfaces may affect the player's body, with respect to the potential for injuries. He suggested that current sports standard tests were inadequate at investigating the playing performance from the point of view of the complexity of the combined effects of, for example, a footballer both running and turning in one continuous motion.

He described a recently completed research project which aimed to develop a new portable pitch tester with the capability to produce a combination of surface loads (normal, translation and rotation) and measure the surface response (see the presentation for pictures of the impressive device developed). Trials have been carried out on both natural and artificial pitches.

He also pointed out that very little testing has been carried on monitoring the performance of the playing surface in relation to player injury.

He went on to describe that since the direct measurement of muscle forces is problematic, it is possible to model the leg while running, using a simplified set of muscles and attachments. This appears to be showing promise for assessing how muscle forces may change with changes in pitch characteristics. In his opinion the future may be to look towards a regime in which a test procedure may be integrated with model studies to assess the correct properties of pitch and footwear and also focus on how athletes should train to avoid injury.

The questions and discussion pointed to a consensus developing whereby player injury is multifactorial, i.e. a combination of the player, their state of fitness, the pitch, the way the game is played and the pitch/footwear interaction.

6. The Construction Perspective

Mike Abbott gave a short introduction to surface types and their requirements. He then explained how pitches can and do degrade over time, and thus result in surface deterioration from both the wear and tear effects of the playing usage and in many cases the 'poor' maintenance operations. He showed a number of slides depicting surface problems, e.g. surface flooding, algal and weed growth. These problems are, it appears, caused by poor attention to detail during installation and lack of basic maintenance procedures and programmes.

He explained how the signs of wear and tear can be evaluated by simplistic tests such as ball bounce and slip related tests. However, he went on to present his thoughts on what data was required in future to help better assess the optimisation of surface performance, and that the industry should collect and share data on:

- Intensity of use
- Rates of degradation (e.g. pile height)
- Age versus hardness
- Age on the porosity and ball bounce characteristics

And that this data could/should come from owner/operators, test houses, consultants, sport governing bodies, researchers and the manufacturers/installers.

He also presented his thoughts on the challenges for the future, regarding the need for pitches that are non-irrigated, more durable, more environmentally sustainable, and for test methods that better relate to the athlete and sport play equipment.

7. Sports Injuries and Surfaces

The final presentation was by Professor Mark Batt from the Centre of Sports Medicine, Nottingham, his talk began with a quote by Janda 1997,

“It is the responsibility of every healthcare provider within the field of sport medicine to enhance injury surveillance techniques and make the practice of prevention of injury, the rule, and not the exception”.

He described the differences between microtrauma (overuse) and macrotrauma (acute) injuries. he also explained the intrinsic injury factors, such as age, sex, athlete flexibility and so on, and the extrinsic factors such as the surface, environmental conditions and so on. He presented some very interesting data that explained the kinetic chain during a tennis serve for example, whereby the forces are summated from the player legs up through the body to deliver the total forces at the wrist. The effects of injury were then explained in relation to its effect on the chain.

He gave a personal view on his experience as an orthopaedic surgeon, and also presented some data from injury studies. These studies, predominantly from the he USA, appeared the suggest that the surface was a less significant factor in injuries than often suggested, and that there are many variables that can affect the propensity to injury. It also showed that players can and do adapt to different surfaces well, given sufficient time to do so.

He gave his personal views on the future research required, and challenges in so doing. These included the need for a sport driven study, a comparison between surfaces, perhaps in some cases also surface specific, and to develop a rationale for new surfaces for the community as well as elite level athletes/users.

The talk stimulated interesting questions and discussion, regarding the effects that the newer artificial surfaces may have on the users if the game is faster, such as from the effects of fatigue. Again the point regarding that previous studies had been carried out by UEFA and FIFA was raised, and it was clear that these studies would ideally be made available to help inform the debate on injuries and their relation to the extrinsic factors such as the surface and shoe wear used.

B. WORKSHOP SESSIONS

After the lunch break the delegates were split into four groups to discuss issues and debate challenges to advancing the knowledge in four key areas. Each group was given one question to debate first, and were also free to discuss the other questions.

The questions for discussion were:

1. The effects of surfaces on the player / users with regard to a performance perspective?
2. The effects of surfaces on the player/users with regard to injuries/health perspective?
3. The Evaluation/measurement of appropriate surface mechanical properties?
4. The innovations for surface design/manufacture/performance including 'whole life'

The groups spent approximately 60 minutes discussing these issues, with a member of the core committee as a convenor, and then returned to the main conference hall to present/discuss the findings.

In brief summary the key points from the four questions/issues were as follows:

1. With regard to injury and health: Long-term studies are required, and these need a multidisciplinary approach. Research studies should consider establishing any trends, a baseline and investigate the relationship between performance, safety and sustainability. Studies of the effects of shoe type, stud type and traction should be undertaken.

With regard to performance, studies should look at: affordability versus need; multi-sport requirements; how to get more people playing sport; surface factors such as temperature and the nature and future requirements for infill; and design for user preference.

2. With regard to injury/health: The ideal pitch requirements are influenced by many factors that require understanding, including: long-term epidemiology studies; environment; human sciences; user education; community use/needs; kinematics; optimal performance parameters such as traction and other including specific sport tasks (relating to knees, ankles).

3. With regard to surface properties: Need to simulate player/ball on the one hand, through to simple quick portable measurements on the other. Future studies should look at identifying spatial variability, variability in the constituent materials, and the changes in performance over time. In addition, the effects on the measurements requires careful researching, such as wet/dry, temperature, load rate and magnitude, static versus dynamic effects and the nature of traction and frictional behaviour. Construction standardisation should also be investigated.

4. With regard to innovations for design/manufacture: Simple test to help decision making with regard to intervention, maintenance and repair would be useful to the industry/operators. Lower cost products, better management strategies, optimised design would enhance 'value for money' of systems/products. Legislation may become a key driver for change, especially environment related such as water resources, recycling and reuse related issues. More data needed on life cycle costs, client education of 'value' engineered designs, and to inform change. User effect studies needed to aid decision making and innovation scope in general.

The overall consensus was that there is plenty of work to be done with regard to researching the testing and monitoring of playing surfaces, and meaningful long-term health related studies. The groups agreed that research programmes and transparent data is required relating to what surfaces are needed for, how to best produce them and that they are suitable for players of all ages and standards, and for all sports.

Groups also argued that systems must be established to effectively ensure the correct long-term maintenance regimes are in place to maintain and sustain these facilities to the maximum benefit.

The source of funding for such research was suggested to come from: Sport governing bodies, sports council, test houses and manufacturers (tax breaks), SAPCA and in collaboration with higher education institution support mechanisms such as the research councils.

Closing session

Dr Fleming thanked the attendees for their attention and participation. He reminded them that this network was in existence to develop and sustain this new community of those interested in sports surfaces. He stated that the day had generated many interesting points for consideration at the future workshops. He urged the attendees to complete the feedback forms, which included the opportunity for all to have a say in the future activities of the network, such as the order and content of the workshops, and the opportunity to be a speaker and a collaborator in future research work.

The questionnaires have been evaluated, and the results are shown in the section below.

Launch session feedback and future network activities.

From the questionnaires returned (twenty) the popularity ranking order, of the seven workshops proposed on the form, was as follows:

Workshop/Question 2. Quantify Performance Requirements for Surfaces

Comprises many aspects of design, construction and materials utilised, mechanical behaviour under loading (including athlete and ball), and influencing factors (such as those environmental, e.g. water). Contrast those

sport specific, indoor and outdoor, on natural and artificial turf. Prioritise the key factors that influence surface performance.

Workshop/Question 3. Increase the Understanding of Player-Surface Interaction:

Through the use of experimental data collection and the development of models. Evaluate current understanding of human response to surface manipulation (e.g. changes in surface impact reduction and sliding properties), including adaptations in movement and force/pressure patterns. Evaluate models available for investigating surface effects. Prioritise research and plan a strategic approach to the integration of biomechanical experimental data and modelling.

Workshop/Question 6. Determine the Effects of Construction/Usage Wear/Ageing on the Surface Performance and Hence Longevity:

Comprises the evaluation of design guidance, best construction practice and current thinking/data regarding the effects of degradation on the surface and its performance. Prioritise the indicators for decision making tools regarding intervention and maintenance/reconstruction requirements. Propose data collection protocols for future record keeping/studies. Involve collaborations with industry and operators.

Workshop/Question 4. Minimise the Risks of Injury Through Play/Training:

Comprises evaluation of current understanding of injury aetiology and the potential of surface types and variations to influence injury nature and incidence. Includes lower limb and overuse injuries, and fall impacts, and requirements for different populations, such as young and elite performers. Plan suitable research approaches to study surface characteristics and their relationship with injury. Prioritise research needs, with inclusion of collaboration of sports governing bodies.

Workshop/Question 5. Measure the Appropriate Surface Characteristics:

Evaluate existing tests/methods BS and CEN etc, determine element and composite behaviour and response to loading. Propose new/amended test methods/protocols for research and development.

Workshop/Question 1. Quantify Performance Requirements for Player/user:

Comprises aspects of player expectation, player perception, player skill level/movement requirements and ball-surface interaction. Prioritise the key factors that influence player performance requirements, at community and elite level.

Workshop/Question 7. Design and Develop New Innovative High Performance/Functional Surfaces:

Consider the outcomes of Question 1-6 and the evolution of current surfaces, the future needs and implications of legislative directives. Develop key strategic areas for research and development primarily to assist the industry in delivering safe and innovative, sustainable and economic surfaces for the future.

In addition, several members made suggestions for topics to be discussed/debated within those proposed or specific workshops; play safety; management of 'real' surfaces linked to playability; focus on indoor surfaces; and the environmental impact of sport surface materials and their long-term health effects on users.

Note: If you are interested in becoming a member of SportSURF please contact the network coordinator Dr C Young at C.Young@SportSurf.org.

More details about the network including future events are available on the website at www.sportsurf.org.

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